Global migration of the highly skilled: a tentative and quantitative approach

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Theo Dunnewijk

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Abstract

Migration in a globalising world is on the increase, especially migration of the highly skilled. It is quite natural that given certain possibilities, people look for opportunities and chances to improve their lives. Especially when the better educated leave their country in large quantities to try their chances abroad it was labelled in the 1960's as 'brain drain' stressing the negative welfare impact on the countries of origin (European at that time). However not always is the impact of migration negative for the country of origin and therefore 'brain drain' turned into 'brain gain' when it was seen from another perspective. Indeed destination as well as origin countries may profit from migrating highly skilled people. The road in the middle is called 'brain strain' emphasising that out migration can be either positive or negative for the origin countries. A synthesis has been found in perceiving migration of the highly skilled in the more neutral phrase 'brain circulation'. Brain circulation perceives migration of the highly skilled not as an end in itself but as the start of a circular process in which everyone might be better off: in this view the knowledge worker in the age of globalisation turns into a real cosmopolite.

Despite an enormous literature on migration it is impossible to draw a systematic global quantitative picture of migration of the highly skilled. Therefore discussions in terms of brain drain, brain strain or brain circulation are either theoretical or end unresolved. Empirically only a part of the picture can be drawn with the help of data on South-North migration of the highly skilled. Data on other directions of migration like South-South and North- South is not systematically covered by the international statistical institutes. Given this situation it is the aim of this paper to include as many as possible countries in the data on migration of the highly skilled in order to illustrate the major effects related to migration for human capital in origin as well as destination regions. This is possible by using UNESCO data on international students; this source facilitates estimations of the missing migration flows. The results show that countries like Russian Federation, South Africa, Ukraine, Malaysia, Jordan and Saudi Arabia are, apart from the traditional immigration countries also important destination countries for highly skilled migrants.

Key words: Migration, Diaspora, Highly skilled migrants, Internationally Mobile Students.

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Short CV:
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Introduction

Migration of the highly skilled is a phenomenon that has been labelled very differently in the course of time. In the nineteen fifties and sixties it was labelled 'brain drain' stressing the assumed negative impact on the European countries of the migration of the highly skilled towards the traditional emigration countries like US, Canada, Australia and New Zealand. Later it was labelled 'brain gain' because destination as well as origin countries may profit from the migrating highly skilled (IOM, 2005 and Mayer and Peri, 2008), while Mattoo, Neugu, Özden (2008) conclude the opposite effect of migration 'brain waste'. The road in the middle was called 'brain strain' emphasising that out migration can be either positive or negative for the origin countries (Lindsay-Lowell cs., 2004). A synthesis appeared as migration of the highly skilled was perceived as 'brain circulation' (Saxenian, 2002) or as 'transmigration' (Danby, 2004). Migration from the perspective of brain circulation is not an end in itself, but the beginning of a circular process in which everyone might be better off. The direction the highly skilled go cannot be seen in isolation from other influences. Circulation of the highly skilled is embedded in the global flows of technology, capital and the media (Castells, 1997, 1999, 2000 and Appadurai, 1996). Migration of the highly skilled therefore today is not simply perceived as leaving the periphery for the core; on the contrary it is perceived as decentralised two way flows of skills, capital and technologies between regional economies with different specialities. (Saxenian, 2006).

Despite an enormous theoretical and empirical literature on migration it is still impossible to draw a systematic global quantitative picture of migration of the highly skilled. Therefore discussions in terms of brain drain, brain strain or brain circulation are either theoretical or end unresolved. It is the aim of this paper to include as many as possible countries in order to draw the global picture of migration of the highly skilled.

This paper is organised as follows: Firstly we present some relevant stylised facts on migration in general and the highly skilled migrants (HSM) in particular. Secondly we present an inventory of the available data on highly skilled migration. Thirdly we test if data on internationally mobile students can be used as a proxy for missing HSM observations. Finally based on the produced data on the origin and destination of HSM's a destination/origin matrix of migration of the HSM in 8 regions reveals the (in and out) flows of HSM for the Arab States, Central and Eastern Europe, Central Asia, East Asia and the Pacific, Latin America and the Caribbean, North America and Western Europe, South and West Asia, Sub Sahara Africa. The paper ends with suggestions for a framework for further research a framework that takes into account the welfare effects of migration of the highly skilled in a proper way by incorporating the impact on local wages and other (indirect) effects of migration.

Aggregate and stylised facts

An aggregate and quantitative view on migration towards OECD is exhibited in Table 1. In 1990 40.3 million migrants lived in the OECD area while a third of them (i.e. 12.1 million) can be regarded as highly skilled. Since then migration of HSM grew with more than 5% annually. Taking this growth and other indications into account we can safely say that in 2007 the number of migrants in the OECD area will exceed 73 million and almost 40% (i.e. 29 million) will be highly skilled, while non-OECD origins exhibit a faster growth rate than OECD origins.

Table 1 Origin of migrants in OECD countries

Highly Skilled migrants (millions)		OECD	Non-OECD	Total
	1990	6.0	6.1	12.1
	2000	8.5	11.5	20.1
	2007E	10.9	18.1	29.0
average annual growth 1990-2000 (%)		3.6%	6.6%	5.2%
Composition (%-share in Total)				
	1990	49.6%	50.4%	100.0%
	2000	42.5%	57.5%	100.0%
All migrants (millions)				
	1990	22.6	17.7	40.3
	2000	28.3	28.7	57.0
	2007E	33.0	40.3	73.3
average annual growth 1990-2000 (%)		2.3%	5.0%	3.5%
Composition (%-share in Total)				
	1990	56.1%	43.9%	100.0%
	2000	49.6%	50.4%	100.0%

source: Docquier and Marfouk, 2004
2007E: these values have been estimated based on the 1990-2000 growth

Among these highly skilled migrants the main categories of professions are ICT and health staff, intra company workers other consultants, highly specialized contractual service suppliers and independent professionals particularly in a North-North or North-South context, but increasingly also in a South-North context.[1] However data on these North-South and South-South flows are not available. Given this situation it is our aim to describe the migration of the highly skilled as complete as possible with the help of additional data, in order to sketch the size and directions of migration for origin as well as destination countries.

[1] http://www.unctad.org/Templates/Page.asp?intItemID=3887&lang=1

Existing data sources

A first attempt to describe skilled migration and assess brain drain came from the IMF, this database has been described in Carrington and Detragiache (1998). A second attempt to describe quantitatively skilled migration was undertaken by the World Bank described in Docquier and Marfouk (2004). In this last mentioned paper the coverage of countries increased considerably but the data remains OECD centric. Both papers concluded that brain drain remains a problem for policy makers of especially small countries, although they use a very simplistic definition of brain drain[2] and ignore possible secondary effects of migration like brain circulation.

World Bank data compiled by Carrington and Detragiache

The database produced by Carrington and Detragiache (1998), hence forth CD1998 covers 61 developing countries[3] for the year 1990 only; they followed a two step procedure: firstly they estimated the migration to the USA of low[4], medium and highly skilled migrants based on 1990 census data[5]. From the migrants aged above 25 to the USA with tertiary attainment (defined as having more than 12 years of schooling) the graduate students in universities in the USA were subtracted[6]. Secondly OECD data has been used to estimate migration to OECD countries, but this data does not contain information on educational attainment and age, while migrants are differently defined. Therefore CD1998 assumed that the distribution of educational attainment among migrants is the same as in the US in each OECD country[7]. Definitions differ among data sources: Immigrants in the US, Australia and Canada are differently defined from the one used in EU. Former countries define nationality of an immigrant based on place of birth while the latter countries use the ethnicity of the parents as definition of foreign born people. Thus for each country of origin in the sample the number of migrants with tertiary education is known. Combined with Barro and Lee (1993) data on educational attainment[8] the levels of low, medium and tertiary educated in each country of origin are known.

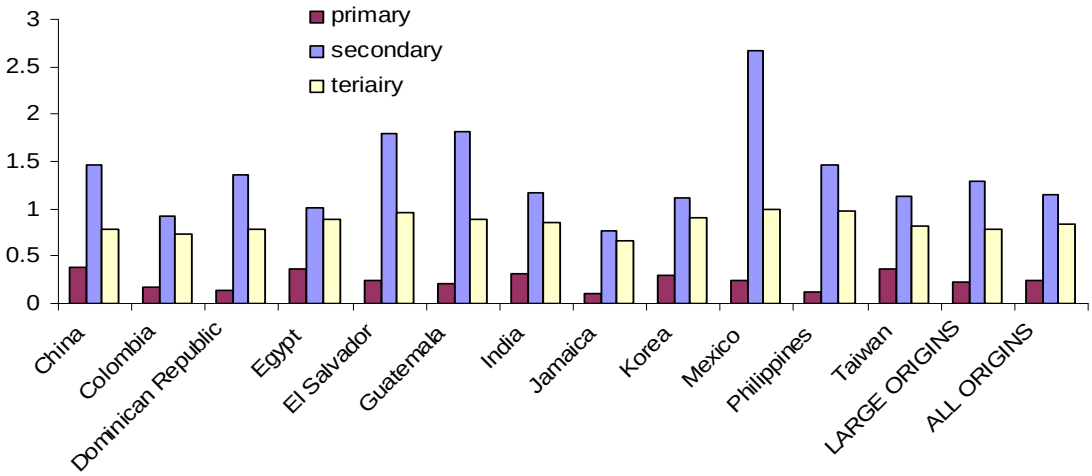
Conclusions of CD1998 were (1) that HSM's are more mobile than the lower skilled, with notable exceptions for Central America and Mexico, (2) the numbers of HSM in several small developing countries is a problem that policy makers cannot ignore (3) migrants are better educated than the average of the population in the country of origin (4) the data is less reliable for countries of origin with little migration to the US and include also people that entered the US at a young age and acquired their education in the US.

[2] Defined as a migration share of the highly skilled of more than 30% of the domestic highly skilled lab our force.
[3] Excluding the Soviet Union and Eastern Europe and among developing countries.
[4] Defined as between 0-8 years of schooling, while medium skilled is defined as between 9-12 years.
[5] From IPUMS, university of Minnesota
[6] The source for foreign born graduates from US universities is known from the Institute of International Education data is available at http://opendoors.iienetwork.org/page/28633/
[7] This of course is more tentative for countries with small numbers of migrants to US than for countries with large numbers
[8] Although Barro and Lee definition of educational attainment: no-primary schooling, secondary schooling, higher school graduates and beyond, differs from the US Census: 0-8 years of schooling, 9-12 years and 13 or more years of schooling.

IMF data compiled by Docquier and Marfouk (2004)
Docquier and Marfouk (2004), henceforth DM2004 improved the coverage of countries origin of migrants considerably. DM2004 have built a database that contains for about 190 countries of origin skilled workers' emigration rates for the year 2000 and for 170 countries in 1990. They define migrants as working age individuals (aged 25 and over) born in a given country but living in another country. The data has been collected from Census or register data and embraces immigration from source countries to OECD countries incorporating information on immigrant's educational attainment: low skilled, medium skilled and high skilled. When no information on educational attainment from a source country is available it is assumed that the distribution is equal to that of immigrants of the same nationality towards another country for which such information is known. Consistency with Barro and Lee (2000) data on education data in the countries of origin is pursued. They used basically two rules: migrants with unknown skill levels are considered to be unskilled, and in receiving countries when no information about skills is available the skill distribution in the rest of OECD-area has been applied.

Of course, both methodologies lead to different and imperfect but very valuable results, especially concerning he migration of the highly skilled. Some of these estimates expressed in terms of CD1998 as a ratio of DM2004 are exhibited in Figure 1. In this figure 12 countries with large numbers of migrants (above 100.000 migrants) to US are explicit exhibited in this figure. The ratio of CD1998 to DM2004 for these observations with regard to tertiary skilled is with around 0.84 fairly constant over the countries of origin and this ration exhibits the lowest variation The other ratios of primary and secondary skilled migrants exhibit much larger difference and more variability. Hence these two databases differ systematically: low skilled is much lower in the CD1998 data base, while secondary skilled is much higher than in the DM2004 data base.

Figure 1 Ratio between CD1998 and DM2004 data on primary, secondary and tertiary skilled migrants in 1990 for 12 major countries of origin and averages for large and all countries of origin with US as destination



Compared with the data from CD1998 the method used by DM2004 is more sophisticated because more information from statistical sources has been used in the production the data. Especially the use of census data for most OECD countries implies more accurate statistics compared with CD1998. Based on these statistics DM2004 claim that CD1998 have underestimated the HSM by around 4%, which is quite accurate. This can be seen in Figure 1 by

the bar of tertiary educated just below 1.0. The DM2004 estimates of the HSM towards US are higher than the CD1998 estimates, therefore it is likely that US bound migration of the medium skilled is overestimated by CD1998, causing underestimation of primary and highly skilled migrants.

One of the conclusions of DM2004 is that there seems to be a decreasing relationship between emigration rates and country population sizes while the disparities are extremely stable between 1990 and 2000. Another is, although loosely stated (and not formally tested) that country size, GDP per capita, inequality and poverty rates are important determinants of emigration. Brain drain is most severe in African and European countries, while Oceania and Asia exhibit intermediate rates and the American brain drain is small.

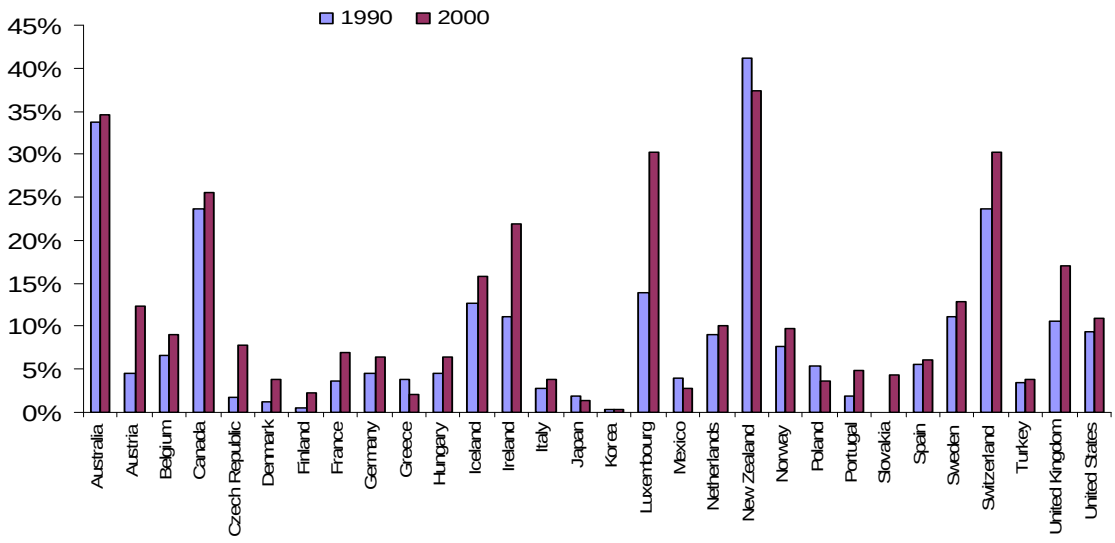
Indeed small poor countries are liable to brain drain, but today's vision is that welfare gain or losses are a matter of proportions: countries that combine relatively low levels of human capital and low skilled emigration rates are more likely to experience a beneficial brain drain (net positive effect) and conversely. Large economies like the main globalising economies of today (Brazil, China and India) all experience non-negligible gains from their migrating highly skilled. These gains depend on the wage premium highly skilled migrants can realize by going abroad together with the formation of human capital and increased wages of the lower skilled in the country of origin. However many small countries e.g. in Sub Sahara Africa and Central America lose, because the proportion of the highly skilled in the workforce declines too much due to migration while financing education becomes a waste instead of an asset. As a consequence in a balanced situation (i.e. under certain conditions) migration of the highly skilled can lead to an increase of the total number of HSM in developing countries and important distributional effects among these economies (Beine, Docquier and Marfouk, 2008).

In the next section we show the impact of migration on the skilled labour force in countries of destination (OECD-countries only) and countries of origin, in terms of brain drain (gain) as defined above. Indeed when a substantial share of the skilled labour force migrates abroad we can see this as a necessary condition for brain drain and it depends on the secondary effects of this migration if the brain drain is "healthy" or "unhealthy". As often the total welfare effect of migration depends not only on the wage premium but also on several other countervailing effects: - like knowledge exchange between those who left and those who stayed, the relative number of returnees, the impact on wages in the destination and origin countries etc.

Impact of migration of the highly skilled on skilled labour force

Brain drain as CD1998 and DM2004 have defined it can be measured by the impact of migration of the highly skilled on the domestic highly skilled labour force. If we accept this limited definition brain drain, then brain gain can be defined as the impact on the highly skilled labour force in destination countries. This is exhibited in Figure 2 for destination countries and in Figure 3 for countries of origin. The data allows us only to describe OECD as destination countries, while countries of origin can be chosen from almost all countries in the world. Given this restriction we see that the traditional 'receiving countries' like Australia, Canada, New Zealand, Switzerland and new receiving countries as Ireland and Luxembourg (since 2000) and exhibit rather large effects caused by HSM on their highly skilled labour force. New Zealand tops the palm with 40% of their highly skilled labour force coming from abroad, compared with the US with only around 10%.[9]

Figure 2 Brain Gain: Highly skilled migrants as % of the highly skilled labour force in 30 OECD destination countries



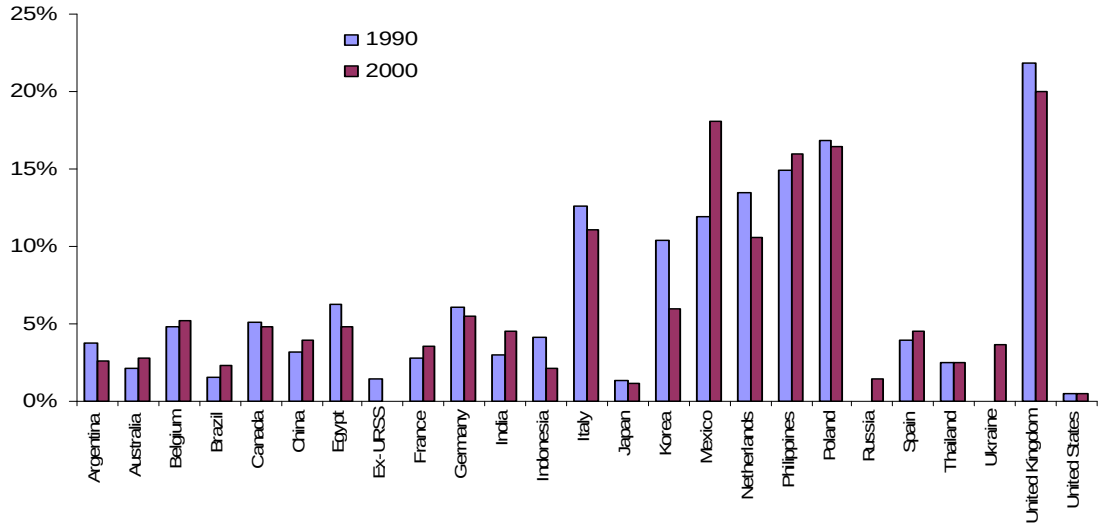
Source: Own calculations based on Docquier and Marfouk, 2004

Immigration of the highly skilled rose between 1990 and 2000 in almost all (OECD) destination countries more than the indigenous highly skilled labour force. The ratio of HSM as percentage of the highly skilled labour force increased in many of the OECD countries but not in Greece, Japan, Mexico, New Zealand and Poland. The ratio skyrocketed in Austria, Czech Republic and

[9] Especially Australia, Canada and New Zealand apply selective migration policies that favour the highly skilled above the lower skilled. More than 50% of all migrants to these countries are highly skilled as compared with less than 20% of the migrants to in the US. There seems to be unanimity in the empirical literature about substantial brain gain in these traditional receiving countries. See e.g. Abella, 2006 for New Zealand, Findlay, 2002 for the UK, Hugo, 2006, Birrell, 2001 and Birrell, c.s., 2006 for Australia.

Luxembourg. This might be caused by events like the collapse of COMECON, the reunification of Germany but also by migration policy changes. Migration policies became more restrictive and more selective in these and other countries; this has reduced the proportion of immigrants dependent on family relationships and increased the proportion of the highly skilled. (UN, 2004)

Figure 3 Brain Drain: Highly skilled migrants as % of the highly skilled labour force in 25 countries of origin



Source: Own calculations based on Docquier and Marfouk, 2004

The most important countries[10] of origin of HSM are exhibited in Figure 3. Large effects – between 10 and 20%- of the highly skilled in terms of the highly skilled labour force in the country of origin are to be found in Italy, Korea, Mexico, Netherlands, Philippines, Poland and the UK. The US (and Japan) exhibit very small effects of migration of the highly skilled labour force, while the effects in China and India are more pronounced, but still far below the 10-20% magnitude of the earlier mentioned countries.

The use of OECD-bound migration data has the disadvantage of leaving other possible important destinations out of sight[11]; therefore we revert to UNESCO data on international mobile students. From the literature it appears that HSM and students follow collective paths in finding their way in the world and therefore student mobility and international mobility of highly skilled workers might be (closely) related. There is ample evidence for the hypothesis that international mobile students go where the highly skilled go. Tremblay (2002) provides many sources that show that students that went abroad have several advantages to stay or return to the destination country for

[10] "Most important" here means the countries with above average migration of the highly skilled, observe that these countries are different for 1990 and 2000 and therefore the figure does show all countries that meet this criterion for 1990 and/or 2000.

[11] Like Russia, Ukraine, India, Saudi Arabia, Pakistan, Kazakhstan, Cote D'Ivoire and Iran. These countries are together with the larger OECD economies the main immigration countries in and around the year 2000, as Parsons c.s. (2005) has shown. However they describe the aggregate bilateral migration stocks and not the highly skilled among those immigrants as we do here.

a job. Tremblay derives from the (US) Science en Engineering Indicators 2000 that among the Indian students in the US, 60% have firm plans to stay after graduation; this is more than 50% for Chinese, UK and Peruvian students. Other authors emphasize that mobility during the actual university study leads to much greater likelihood of international mobility after graduating (Teichler and Jahr, 2001, King and Ruiz-Gelices, 2003 and Findlay c.s., 2006). Many more examples can be provided based on the empirical migration literature –on a case by case basis- but we abstain from these details because we pursue here a picture of the global pattern of migration of the highly skilled.

Thus the evidence from this work inspired me to use UNESCO data on international mobile students in an attempt to fill the gaps (i.e. the non-OECD destinations) in the OECD bound migration data. In the next section we discuss this new data source and by simply combining the two databases we may have the possibility to draw a more elaborate picture of global migration of the highly skilled.

Data on Internationally mobile Students

UNESCO data on international mobile students (IMS) describes the numbers of students that leave their home country and move to another country for a study. Internationally mobile students are distinguished with citizenship, permanent residence and prior education. The data presented in the UNESCO database may not be entirely comparable among countries due to differences in the criteria used to report the data concerning IMS and describes the situation around 2000.[12] (See for more details on definitions the statistics portal of UNESCO-UIS/OECD/Eurostat, 2005[13])

For some countries- China being the most prominent - only destinations are known while foreign students in China are unknown. This is the case for quite a number of developing countries and for cases in which the number of students is lower than 1000; I assume that therefore the regional aggregation of the data is more reliable than the data for individual countries, although the estimation of stocks of HSM in these countries (regions) are probably slightly underestimated.

The numbers of IMS more than doubled between 1990 and 2007, this is exhibited in Table 2. This is mainly the result of a general increase in tertiary enrolment and not so much as a result of increased international orientation among students: in fact the actual share of IMS only rose marginally.[14]

[12] The bilateral data at my disposal is only available for the years "around" 2000 and not always available for both destinations and origins. Future versions of this paper will address this incompleteness of the data.
[13] http://www.oecd.org/topicstatsportal/0,2647,en_2825_495609_1_1_1_1_1,00.html
[14] Global Education Digest 2006, page 34

Table 2 Origin of internationally mobile students

Internationally mobile students (millions)	OECD	Non-OECD	Total
1990			1.3
2000	0.7	1 0	1.7
2007E	0.8	1.8	2.6
Average annual growth 1990-2000 (%)			2.7%
Average annual growth 2000-2007 (%) E			6.3%

Source: UIS database, internationally mobile students, E: estimated by the author

Highly skilled migrants vs. internationally mobile students

In this paragraph we test Tremblay's assertion that the number and origin of students who went abroad are indicative for where the HSM go. An indication for a possible but yet unknown relationship between stock of HSM and stock of IMS - for each origin - is the relation between the cumulative distributions of the two. Figure 4 exhibits on the X-axis the share of highly skilled migrants ordered from the highest to the lowest shares (per country of origin) while the Y-axis represents the concomitant cumulative student's share. From this figure it is clear that with the exception of the "upper-tail" the cumulative distributions of the skilled migrants and international mobile students are highly correlated. A linear relation suggested by the dotted line describes the ratio HSM to IMS well, although not perfect. Among the countries with large HSM-shares (depicted by the dots at the left side lower corner of the figure) there are quite a number of countries with relatively large numbers of IMS compared with HSM in particular China (CN), Netherlands (NL), Greece (GR), Turkey (TR), Morocco (MA) and Indonesia (ID). This is exhibited in Figure 4 by the "discontinuities" in the relation between HSM and IMS. However the "tail" above the dotted line at the right- hand upper corner of the figure is populated with the majority of the countries that send more students but few highly skilled migrants abroad.

Based on the data two pictures of the patterns of destination and origin of HSM and IMS in five world regions can be drawn which are given in

More important than the size of flows and stocks is the question if the patterns of HSM and IMS match. At first sight the data on IMS more or less confirm the pattern of the HSM, based on OECD destinations. Of course it is a rough way to compare, but the sizes of the stocks that came from within and towards North America and Western Europe (NA-WE) and the region that consist of African (SWA, SSA) Latin American (LA) and Arabian countries (AS) and East Asia and the Pacific (EAP) region exhibit patterns that are not very different. The interregional mobility in Central and Eastern Europe (CE), the African, Latin American and Arabian region (SWA, SSA, LA, AS) and East Asia and the Pacific (EAP) are indications of missing circuits in Figure 5.

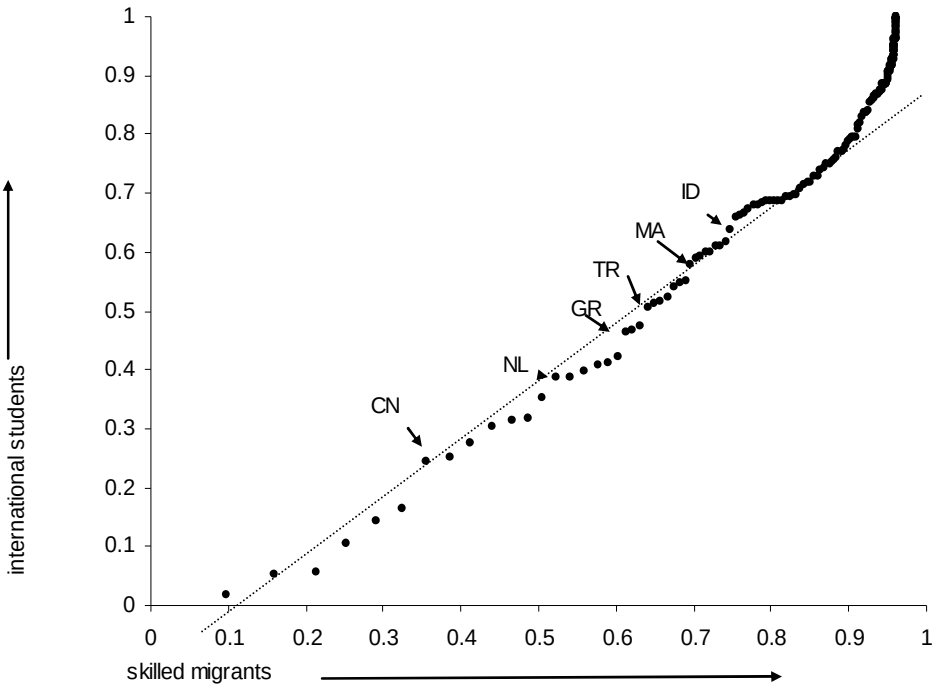
Figure 5 and

Figure 6. The arrows in these figures point from the origin towards the destination regions, while the width of the arrow represents the stocks (as accumulated past flows) as far as they account for more than 1% of the total. These figures have to be interpreted with care: in Figure 5 the destination countries are OECD countries, while in Figure 6 the destination and origin countries are the countries having more than 1000 students abroad or at home[15].

North America and Western Europe (NA-WE) function as the strongest magnet: most of the HSM as well as the ISM settled in this region, HSM that moved within this region account for 30.2% of the total. HSM that went to NA-WE from South West Asia (SWA), Sub Sahara Africa (SSA), Latin America and the Caribbean (LA) and the Arab States (AS) taken together make up 25.1% of the total, this is more than the HSM from East Asia and the Pacific (EAP), that make up 19.1% of the total. The stock from Central and Eastern Europe (CE) is smaller than the cumulated flow from Eastern Asia and the Pacific (EAP). Within region flows are small in Central Europe (CE) and East Asia and the Pacific (EAP) and is (almost) non existent in the other regions, with the exception of North America and Western Europe (NA-WE).

Figure 4 X-Y plots of cumulative distributions of highly skilled migrants and international students (share in total of 2000, country of origin)

[15] See for the selection of countries Appendix 1, this restricted set of countries has the consequence that from the 29 million HSM in the Docquier and Marfouk data , mentioned in Table 1 only 14.6 million are part of the analysis.



More important than the size of flows and stocks is the question if the patterns of HSM and IMS match. At first sight the data on IMS more or less confirm the pattern of the HSM, based on OECD destinations. Of course it is a rough way to compare, but the sizes of the stocks that came from within and towards North America and Western Europe (NA-WE) and the region that consist of African (SWA, SSA) Latin American (LA) and Arabian countries (AS) and East Asia and the Pacific (EAP) region exhibit patterns that are not very different. The interregional mobility in Central and Eastern Europe (CE), the African, Latin American and Arabian region (SWA, SSA, LA, AS) and East Asia and the Pacific (EAP) are indications of missing circuits in Figure 5.

Figure 5 Highly skilled migrants in OECD destination countries in 2000
N=14.6 Million

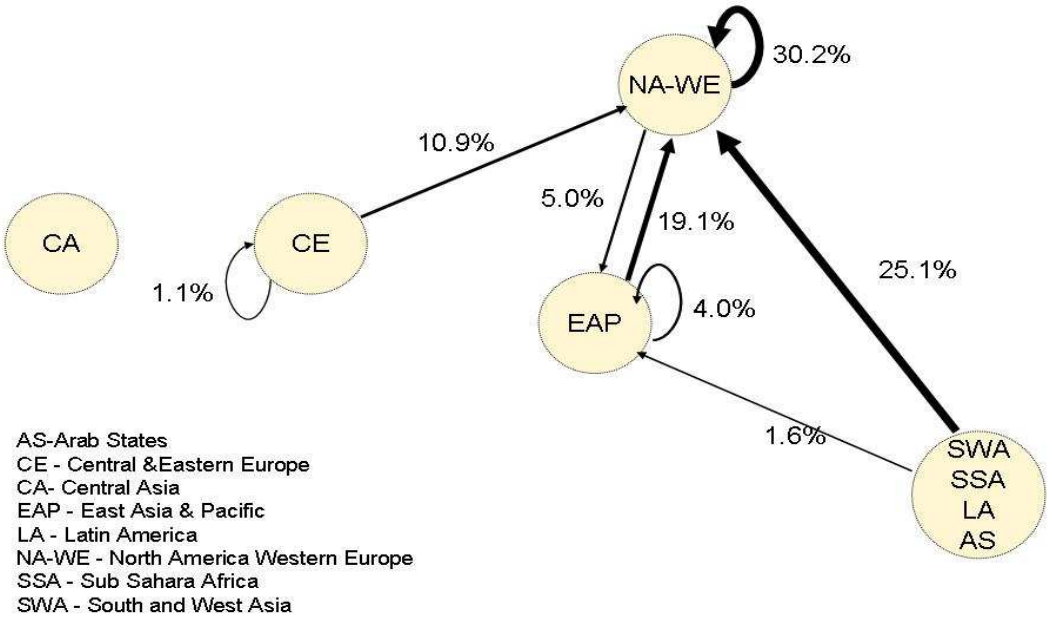
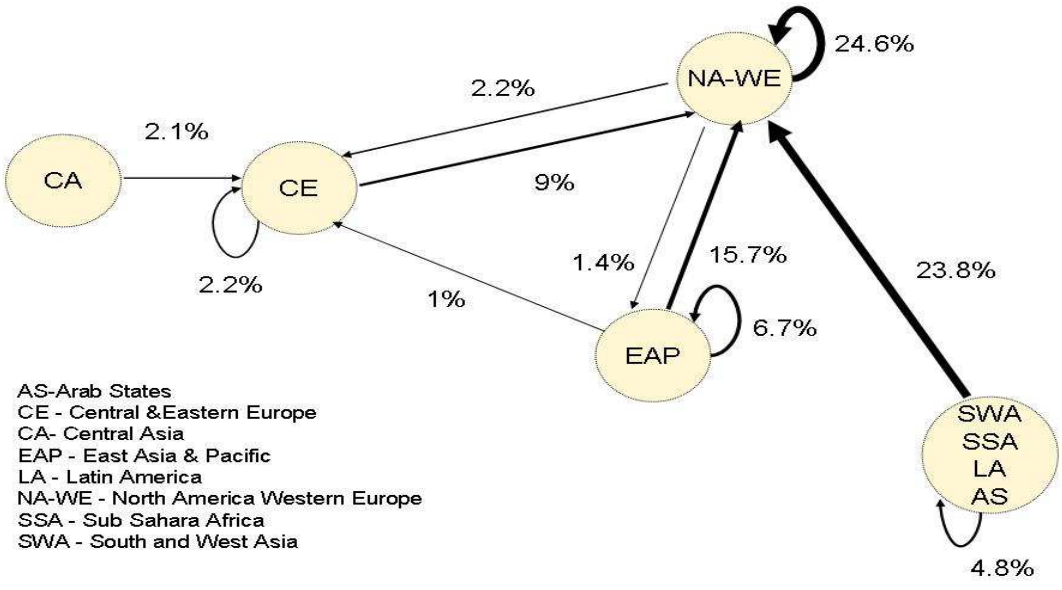


Figure 6 International mobile students in 2000
N=1.7 Million



Comparing both figures reveals two things: firstly the order of magnitudes from

Figure 5 is also present in Figure 6, and secondly the additional information looks plausible. Additional information in this case are the inter regional stocks of mobile students within the African, Latin American and Arabian region (SWA, SSA, LA and AS) and the circuit between Eastern Asia and the Pacific (EAP) as well as Central Asia (CA) and Central Europe (CE) and from North America and Western Europe (NA-WE).

What do internationally mobile students tell us about the highly skilled migrants?

If we apply linear regression in order to supplement the (missing) HSM observations towards non-OECD countries with the help of IMS data, then we can test the Tremblay hypothesis. This has been done in the following equation which describes the relation between IMS (IMS2000) and highly skilled in OECD countries (HSM2000) is used in the calculation[16]:

$$HSM2000 = \underset{(25.696)}{4.733} * IMS2000 + \underset{(52.362)}{193093.5} * HSMGT3 \text{ , } R^2 = 0.626, \text{ DF= } 3270,$$

For HSM2000>0.0

This equation "predicts" the number of highly skilled migrants that migrated from the home country to the host country as 4.733 times the number of international students from the same home country in the same host country, while for large Diasporas (larger than 3 times the standard deviation of the standardised variable) this number must be increased by almost 200.000 (193093.5 to be precise).

About 100 cases can be regarded as "outliers+" (i.e. observations that deviate more than + 3 * standard deviation from the average). Most of these cases are the Diasporas in the traditional immigration countries US, UK, Australia, Canada and also France belongs to this group mainly because of its African connection.

- US: 22 large Diasporas are present in the US from China, India, Japan, Korea, Canada, Indonesia, Thailand, Turkey, Mexico, Germany, Brazil, United Kingdom, Malaysia, Hong Kong (China), France, Pakistan, Russia, Colombia, Kenya, Saudi Arabia, Venezuela and Sweden.
- UK: 15 large Diasporas from Greece, Ireland, Germany, France, US, Malaysia, Hong Kong (China), Spain, Japan, China, Pakistan, Italy, Singapore, Norway, Sweden and India.
- Germany: 14 large Diasporas from Turkey, Poland, Greece, Iran, Italy, Austria, China, Russia, France, Morocco, Spain, Korea, Croatia and Serbia & Montenegro.
- Australia: 8 large Diasporas from Malaysia, Singapore, Indonesia, Honduras, China, India, UK, and New Zealand.

[16] All variable has been z-transformed.

- France: 5 large Diasporas from Morocco, Algeria, Tunisia, Germany and Senegal.
- Canada: 3 large Diasporas from China, US and France

In conclusion it turns out that the UNESCO data on IMS can be used as a proxy to describe several missing observation especially the observations on migrants in non-OECD countries. Most of the large Diasporas are observed in the DM2004 data, thus the main contribution of our method is that especially 10 large and quite a number of smaller Diasporas that settled in non-OECD countries are unveiled.

These Diasporas are present in:

- South Africa originating in Zimbabwe, Botswana, Namibia and Lesotho;
- Russia from Kazakhstan, Ukraine and Belarus;,
- Ukraine, from Brunei Darussalam;,
- Czechoslovakia (former) from Iran;
- Malaysia from China and India;
- Latvia from Israel;
- Romania from Moldova;
- Jordan from Palestine Autonomous Region;
- Tajikistan from Uzbekistan;
- Bulgaria from the Greece.

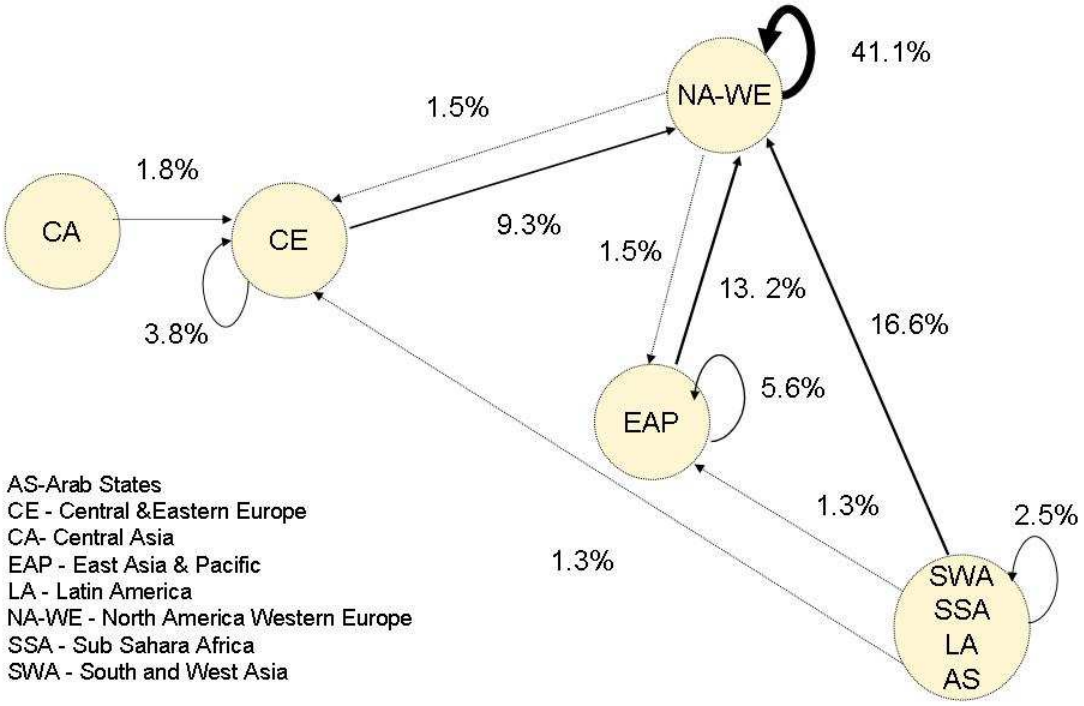
Using these results and assuming that the z-transformed IMS and HSM variables have z-distribution that follows the relation exhibited in Figure 4 [17] we can recalculate and redraw the broad picture based on estimated numbers of HSM, this is exhibited in Figure 7

What can be said about these results, especially the difference in the landscape between the figures 5, 6 and 7?

Firstly the global landscape that appears from Figure 7 especially with regard to the African, Latin American and Arabian region changed most prominently in Figure 7.
Secondly the stock of migrants from the African, Latin American and Arabian region (SWA, SSA, LA and AS) towards North America and Western Europe (NA-WE) diminished (from 23.8% to 16.6%) and new stocks of migrants from the African, Latin American and Arabian region (SWA, SSA, LA and AS) towards Central Europe (CE) and East Asia and the pacific (EAP), which account for more than 2.5% of the migrants, appear on the chart. Thirdly the inter-regional flows in North America and Western Europe (NA-WE) and Central Europe (CE) increased considerably.

Figure 7 Estimated Stocks of Highly Skilled Migrants, 2000, N=19.1 Million

[17] To be precise in figure 4 the z distributions are related according to z(ISM) = 0.1+ z(HSM)



In conclusion we can say that the landscape suggested in Figure 5 (based on OECD destinations only) is a biased one. Indeed the destinations as South Africa, Russia, Ukraine, Malaysia and Jordan are real existing destinations for the Highly Skilled; however these stocks are much smaller than the stocks existing in the OECD universe. Furthermore it turns out hat Central Europe (CE) and the African, Latin American and Arabian region (SWA, SSA, LA, AS) are less peripheral in Figure 7 as compared with Figure 5.

The aggregate wage premium of migration of the highly skilled

Now we have estimates of migration of the highly skilled from everywhere to everywhere we can use these Diasporas to "estimate" quite naïvely a first order redistribution effect by assigning GDP per head – as an approximation of the wage premium- in the region of destination minus GDP per head in the region of origin to a highly skilled migrant. This has been done in Table 3, there it is exhibited in which region gain or loose from migration. For example migrants from all over the world produce in North America and Western Europe (NA-WE) $ 140.5 billion -given the wage premiums and due to outmigration it "looses" $8.81 billion. The last row and utmost right column of Table 3 gives these effects for all regions.

The conclusion is that all destination regions incur redistribution losses, except North America and Western Europe. The total first order redistribution effect is almost $135 billion and is mainly produced in North America and Western Europe (NA-WE) by migrants from the other regions. Migrants from East Asia and the pacific (EAP) are the owners of $ 44.3 billion, while North American and Western Europe (NA-WE) migrants loose $10.8 billion

Table 3 Differences in GDP per head in the regions of the world and the accompanying income redistribution effects

		Region of Origin								
	Difference in GDP per Capita between Region Destination and Origin (*$1000)	AS	CE	CA	EAP	LA	NA_WE	SWA	SSA	*Redistribution ($ BLN)*
Region of Destination	Arab States (AS)	0.0	-1.2	5.2	-3.1	1.0	-20.7	4.9	4.6	-0.1
	Central and Eastern Europe (CE)	1.2	0.0	6.4	-1.9	2.2	-19.5	6.1	5.8	-2.2
	Central Asia (CA)	-5.2	-6.4	0.0	-8.4	-4.2	-25.9	-0.3	-0.6	-0.1
	East Asia and the Pacific (EAP)	3.1	1.9	8.4	0.0	4.1	-17.6	8.1	7.8	-3.0
	Latin America and the Caribbean (LA)	-1.0	-2.2	4.2	-4.1	0.0	-21.7	4.0	3.6	-0.1
	North America and Western Europe (NA_WE)	20.7	19.5	25.9	17.6	21.7	0.0	25.6	25.3	140.5
	South and West Asia (SWA)	-4.9	-6.1	0.3	-8.1	-4.0	-25.6	0.0	-0.3	-0.1
	Sub-Saharan Africa (SSA)	-4.6	-5.8	0.6	-7.8	-3.6	-25.3	0.3	0.0	0.0
	Redistribution ($ BLN)	*23.7*	*34.4*	*2.8*	*44.3*	*17.8*	*-10.8*	*15.4*	*7.4*	*135.0*

Source: Author's calculations

Conclusions and further research

It turns out that the UNESCO data on internationally mobile students can be used as a proxy to describe missing observations especially the observations in the Docquier and Marfouk data on migrants in non-OECD countries. This paper unveils 10 large and quite a number of smaller Diasporas that settled in non-OECD countries that are missing in the Docquier and Marfouk database on migration of the highly skilled. Especially Diasporas in South Africa originating in Zimbabwe, Botswana, Namibia and Lesotho, Diasporas in Russia from Kazakhstan, Ukraine and Belarus in Ukraine, from Brunei Darussalam, in Czechoslovakia (former) from Iran; in Malaysia from China and India; in Latvia from Israel, in Romania from Moldova, in Jordan from Palestine Autonomous Region, in Tajikistan from Uzbekistan and in Bulgaria from the Greece are missing.

Further research
Migration in a neoclassical model increases the labour supply in the host country evoking more production a wage reduction and a welfare gain. Due to migration the welfare gain under the assumption of constant returns to scale equals halve the increase in the labour supply multiplied by the wage rate reduction. (see e.g Freeman, 2006). However such an aggregate view is not the perspective of the migrant who wants to improve her/his net present value abroad by migrating from country i to country j compared with this value at home taking into account the costs incurred and the options at the disposal of the migrant to move. It is our intention to proceed along these lines – with the data produced in this paper- eventually in order to better understand the global welfare effects of migration of the highly skilled and to begin with the meaning and significance of the wage premium, the Diaspora and the cultural proximity of countries oversees for highly skilled migrants.

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Appendix 1.

Regions and Countries included in the estimation of Highly Skilled Migrants

Arab States:
Algeria, Bahrain, Iraq, Jordan, Lebanon, Morocco, Qatar, Saudi Arabia, and Tunisia

Central Europe
Belarus, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Poland, Moldova (Republic of), Romania, Russia, Slovakia, Turkey, Ukraine

Central Asia
Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan

East Asia and the Pacific
Australia, Fiji, Hong Kong (China), Japan, Macao (China), Malaysia, New Zealand, Philippines, Korea, (South Republic of),Thailand, Viet Nam

Latin America and the Caribbean
Argentina, Bolivia, Brazil, Chile, Costa Rica, Cuba, Mexico, Uruguay, Venezuela

North America and Western Europe
Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States

Sub Sahara Africa
Cameroon, Madagascar, Mali, Namibia, Senegal, South Africa, Togo

South and West Asia
India, Iran (Islamic Republic of)

OECD Member States
Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.

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